20/5/2010

Realization of one port network using RC and RL

LC

2 Condition of LC:

$$\frac{N(S)}{D(S)} = \frac{\text{odd}}{\text{even}} \quad \text{or} \quad \frac{\text{even}}{\text{odd}}$$

$$|\text{degree of } N(s) - \text{degree of } D(s)|$$

RC

$$Z(S) = \frac{N(S)}{D(S)} \quad \text{or} \quad Y(S) = \frac{N(S)}{D(S)}$$

$$\boxed{\frac{N(S)}{D(S)} = \frac{\text{odd} + \text{even}}{\text{odd} + \text{even}}} \leftarrow \begin{matrix}RC \\ \text{or} \\ RL\end{matrix}$$

$$\boxed{\begin{matrix} Z(0) \geq Z(\infty) \\ Y(0) \leq Y(\infty) \end{matrix}} \rightarrow RC$$

RL

$$Z(S) = \frac{N(S)}{D(S)} \quad \text{or} \quad Y(S) = \frac{N(S)}{D(S)}$$

$$\frac{N(S)}{D(S)} = \frac{\text{odd} + \text{even}}{\text{odd} + \text{even}}$$

$$\boxed{\begin{matrix} Z(0) \leq Z(\infty) \\ \\ Y(0) \geq Y(\infty) \end{matrix}} \rightarrow RL$$

لازم نتأكد من الحل بالنهاية

Ex 1: Realize using cauer I

$$Z(s) = \frac{3s^2+18s+24}{s^2+3s}$$

Sol:-

$$Z(s) = \frac{3s^2+18s+24}{s^2+3s}$$

$s^2+3s \,\big|\, 3s^2+18s+24$

$\boxed{3}$ $\quad$ $-3s^2 - 9s$

$Z_1 = R_1$

$R_1 = 3\Omega$

$9s+24 \,\big|\, s^2+3s$

$\boxed{\frac{1}{9}s}$ $\quad$ $-s^2 - \frac{24}{9}s$

$Y_2 = \frac{1}{9}s$

$C_2 = \frac{1}{9}F$

$\frac{1}{3}s \,\big|\, 9s+24$

$\boxed{27}$ $\quad$ $9s$ ~~24~~

$Z_3 = R_3$

$R_3 = 27$

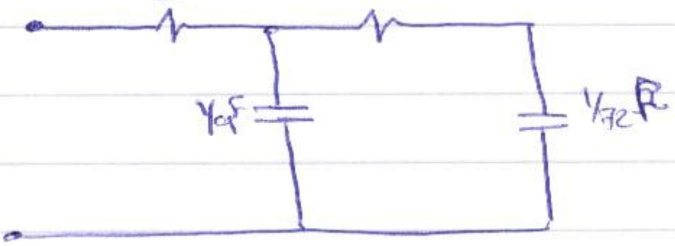
$24 \,\big|\, \frac{1}{3}s$

$\boxed{\frac{1}{72}s}$ $\quad$ $\frac{1}{3}s$

0

$Y_4 = sC_4$

$C_4 = \frac{1}{72}F$



Cauer I
x
Cauer II

أهم حاجة الترتيب ف

Ex2: Realize using Cauer II

$$y(s) = \frac{3s^2+18s+24}{s^2+3s} = \frac{24+18s+3s^2}{3s+s^2}$$

$3s+s^2 \,|\, 24+18s+3s^2$

$y_1 = \frac{8}{s} \leftarrow \boxed{\frac{8}{s}}$ $\quad \bar{24} \; \bar{+} \; 8s$

$L_1 = \frac{1}{8} H$

$10s+3s^2 \,|\, 3s+s^2$

$Z_2 = R_2 \leftarrow \boxed{\frac{3}{10}}$ $\quad \bar{3s} \; \bar{+} \; \frac{9}{10}s^2$

$R_2 = \frac{3}{10} \; \Omega$

$\frac{1}{10}s^2 \,|\, 10s+3s^2$

$y_3 = \frac{1}{sL_3} \leftarrow \boxed{\frac{100}{s}}$ $\quad \bar{10s}$

$L_3 = \frac{1}{100} H$

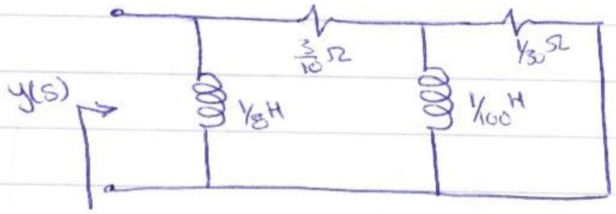
$3s^2 \,|\, \frac{1}{10}s^2$

$\leftarrow \boxed{\frac{1}{30}}$ $\quad \frac{1}{10}s^2$

0

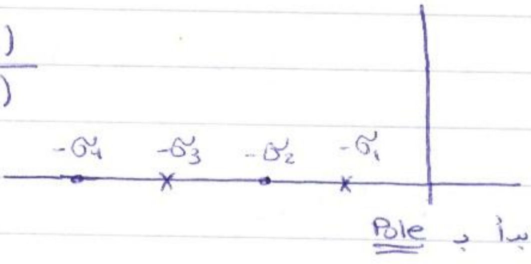
$Z_4 = \frac{1}{30} = R_4$

$\therefore R_4 = \frac{1}{30} \Omega$


y(s)
3/10 Ω
1/30 Ω
1/8 H
1/100 H

Properties of Z_{RC} or Y_{RL}

$$Z(s) = \frac{H(s+\sigma_2)(s+\sigma_4)}{(s+\sigma_1)(s+\sigma_3)}$$


$-\sigma_4$
$-\sigma_3$
$-\sigma_2$
$-\sigma_1$
Pole
بدأ ب

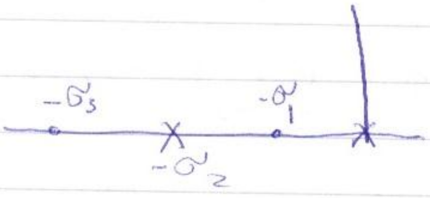
(1): The poles and zero are Simple and are located in -ve Real axis an alternate.

يعني مفيش تكرار
كله على
الـ real

Ze Pole Zero, Pole

(2) It starts with a pole. (may be at origin)

$$Z(s) = \frac{H(s+\sigma_1)(s+\sigma_3)}{s(s+\sigma_2)}$$


$-\sigma_3$
$-\sigma_1$
$-\sigma_2$

Starting inductor

Debook

realizing لازم نرسم الدائرة في الـ

حفظ الدوائر

Foster I

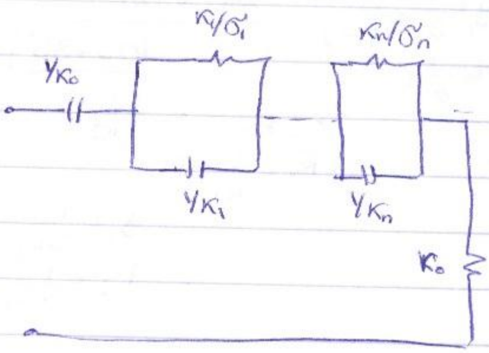
$$\boxed{Z(s) = \frac{K_0}{s} + \sum_{i=1}^{n} \frac{K_i}{s+\sigma_i} + K_\infty}$$

** حفظ

$$K_0 = \lim_{s \to 0} s\,Z(s)$$

$$K_\infty = \lim_{s \to \infty} Z(s)$$

$$K_i = \lim_{s \to -\sigma_i} (s+\sigma_i)\,Z(s)$$



Example (s):-

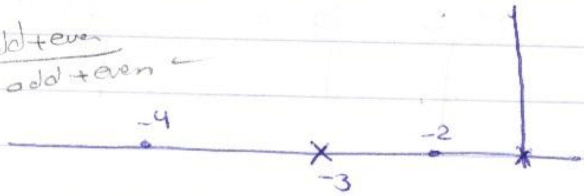
Realize using foster I

$$Z(s) = \frac{3(s+2)(s+4)}{s(s+3)}$$

sol:-

$$Z(s) = \frac{3s^2+18s+24}{s^2+3s}$$

$\frac{\text{odd} + \text{even}}{\text{odd} + \text{even}}$ ←



$Z_0 = \infty$ $\quad Z_\infty = 3$

$Z(0) > Z(\infty) \Rightarrow$ RC

$$Z(s) = \frac{K_0}{s} + \frac{K_1}{s+3} + K_\infty$$

$$K_0 = \lim_{s \to 0} s\,Z(s) = 8$$

$$K_\infty = \lim_{s \to \infty} Z(s) = 3$$

$$K_1 = \lim_{s \to -3} (s+3)\,Z(s) = \underline{1}$$

لازم يطلع يكون +ve

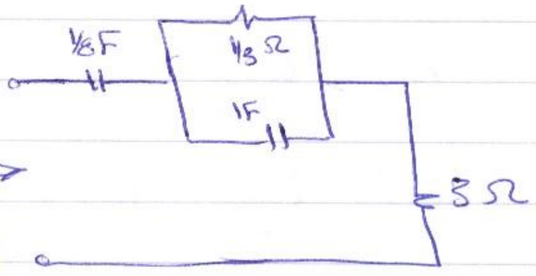
$$Z(s) = \frac{8}{s} + \frac{1}{s+3} + 3$$

$$= \frac{1}{sC_1} + \frac{1}{y_{2a} + y_{2b}} + R_3$$

$$= 1/sC_1 + \frac{1}{sC_3 + 1/R_2} + R_3$$

$C_1 = 1/8\,F$ $C_3 = 1F$

$R_3 = 3\,\Omega$ $R_2 = 1/3\,\Omega$


1/8F
1/3 Ω
1F
3 Ω
Z(s)

Foster II

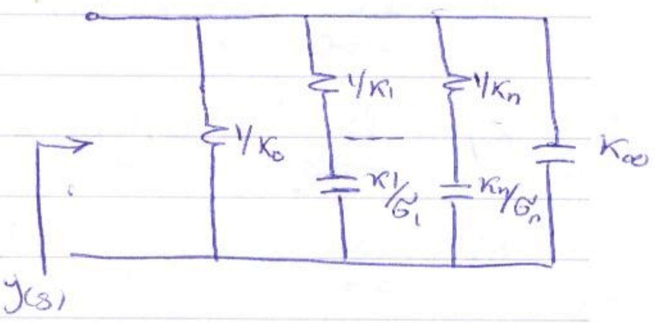
- It Deals with only $y(s)$
- It provides parallel network

$$\boxed{y(s) = \frac{K_0}{s} + \sum_{i=1}^{N} \frac{K_i}{(s+\sigma_i)} + K_\infty}$$

$$K_0 = \lim_{s \to 0} s\,y(s)$$

$$K_\infty = \lim_{s \to \infty} y(s)$$

$$K_i = \lim_{s \to -\sigma_i} (s + \sigma_i)\,y(s)$$


1/K_0
1/K_1
K_1/σ_1
1/K_n
K_n/σ_n
K_∞
y(s)

لم بيجي كالامتحان

Ex (4) : realize using foster II

$$y(s) = \frac{(s+1)(s+4)}{4(s+2)(s+5)}$$

sol:

$$y(s) = \frac{K_0}{S} + \frac{K_1}{S+2} + \frac{K_2}{S+5} + K_{\infty}$$

$$K_0 = \lim_{s \to 0} S\,y(s) = 0$$

$$K_{\infty} = \lim_{s \to \infty} y(s) = 1/4$$

$\frac{-)(2)}{(4)(3)} =$

$$K_1 = \lim_{s \to -2} (S+2)\,y(s) = -1/6$$

$\frac{(-4)(-1)}{4(-3)}$

$$K_2 = \lim_{s \to -5} (S+5)\,y(s) = -1/3$$

أول ما ألاقي K_1 و K_2 طلعوا بـ -ve

بغير الحل $y'(s) = \frac{y(s)}{s}$

$$y'(s) = \frac{y(s)}{s}$$

$$y'(s) = \frac{(s+1)(s+4)}{4s(s+2)(s+5)}$$

$\frac{4}{4(2)(5)}$

$$K_0 = \lim_{s \to 0} s\,y'(s) = 1/10$$

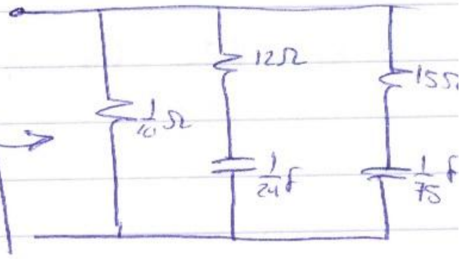
$\frac{(-1)(2)}{(-8)(3)}$

$$K_{\phi} = \lim_{s \to -2} (s+2)\,y'(s) = 1/12$$

4

$$K_2 = \lim_{s \to -5} (s+5)\,y'(s) = 1/15$$

$\frac{(-4)(-1)}{(5)(-3)}$



$$y(s) = s\,y'(s)$$

$$y(s) = \frac{1\cancel{s}}{10\cancel{s}} + 0 + \frac{1/12\ S}{S+2} + \frac{1/15\ S}{S+5}$$

$$= \frac{1}{10} + \frac{\cancel{1/2\,S}\ 1}{12+\frac{1}{s}} + \frac{1}{15+\frac{1}{S/}}$$

- Realize using foster I

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)} \Rightarrow RL$$

- Realize using caure II

$$Z(s) = \frac{2s^2+8s+6}{s^2+8s+12} \Rightarrow \underline{\underline{RL}}$$

3 hours → 5 Question or 6 Question   ركز ع 4,5,6 & 7

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- Realize using foster I

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)} \Rightarrow RL$$

- Realize using caure II

$$Z(s) = \frac{2s^2+8s+6}{s^2+8s+12} \Rightarrow \underline{RL}$$

3 hours → 5 Question
or 6 Question

ركّز ع 4,5,6 & 7

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